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ATTITUDE OF LABOR TOWARDS SCIENTIFIC MANAGEMENT

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It was the autocrat, if I remember rightly, who said that there were always three Johns existing simultaneously in any individual John: the ideal John as John is known to other people; the ideal John as John conceives that he knows himself; the real John different from both the others and known only to his Maker. What that kindly philosopher would have said as to the possible number of attitudes of any group of men towards his own science of medicine or of the attitudes of labor towards our new science of management it is hard to say. One piece of advice I believe Dr. Holmes, with his scientific liking for definiteness of literary expression, would have given when confronted with a topic like that which heads this paper. I believe that he, like myself, would have felt that a science is too protean, too many sided, for any brief discussion of general attitudes to be effective. To gain real value in any brief consideration of a science we must separate out a single theory, a single law, or a single set of principles from the whole content of the science, consider the attitude of a definite type of man or group of men towards that theory, and limit the discussion to that. Nothing less than a volume would give definite form to the whole group of laws and theories that make up the science of management. Another volume would be needed to define all the different attitudes of labor towards that science.

Certainly the general theory of the science of management, of the change of mental attitude that results in true cooperation, of the substitution of exact knowledge for guess work, of the turning of all that is best in science and in scientific method to the use of industry, is too great for general discussion here. We must concern ourselves in this instance with those vital needs of the worker which most affect his attitude towards any new philosophy of industry, recognizing that his attitude is sure to be largely affected by the completeness with which that new philosophy, carried out in prac-

tice, meets his most vital wants. I have been so fortunate as to be personally acquainted with some hundreds of workmen engaged in different industries, and I have studied with deep interest their aspirations and their needs. I have come to see that most thinking American workmen share in common a group of wants which they desire not only for themselves but also for their children. To the best of my ability I have endeavored to define those wants in the paragraphs given below. These wants are—

Favorable working conditions which will enable the worker to preserve that bodily strength which is one of his most valuable assets.

Permanency of employment, which will enable him to order his life on a regular basis.

Good wages, such as will enable him to keep up a thoroughly self-respecting standard of living.

Cooperation, the feeling of working with others towards a desired end rather than working for others in the gaining of an unseen end.

Opportunity for education, which means opportunity for advancement.

Justice, which means some fair basis of contract between employer and employee.

All those wants are supplied by the science of management. The attitude of the thinking worker, who is in a shop where scientific management is installed, who actually sees his most vital wants being gradually met month by month and year by year as the science progresses is the attitude of labor which I have chosen to consider here. That attitude passes from tolerance to cordial appreciation and to hearty liking. To trace the changes through the meeting by scientific management of all the worker's wants, however, would require ten times the space at our disposal here. A single want must be chosen, and the nature of that want and the way in which the principles of scientific management meet the needs of the thinking worker in the scientifically managed shop must be considered. Only when limitation and definition take the place of generalities can understanding of a new science advance. I have, therefore, limited myself here to the desire of the worker whom I have chosen as my type for that education which means advancement, and to the attitude of that worker towards the educational theories of the science of management.

From the very first, education was made a vital part of the science of management and few of the theories of that science are more completely differentiated from those of the older factory theory of management. Recognized at an early stage as a necessity, the education of the worker has been a matter of constant development along the lines which Dr. Taylor has set forth in the second and third of his "Principles of Scientific Management."

It is rather remarkable that the introduction of education into the working hours of industry did not begin earlier, for the desire for education, for self-development, is in the very air that the American breathes. Wearied with the day's toil, thousands of ambitious workmen hasten to the night school in an effort to obtain the education that they crave. Thousands of other workmen struggle in their rooms with the lessons of the correspondence school. How great their effort is, how overmastering that desire for education, few realize save the teachers of those classes. It is a mighty force and I, like hundreds of others who, in years gone by, have taught in the night schools, bear witness to its greatness.

That stimulus to advance through education which finds expression in night work comes from the individual's desire for his own mental and material advancement. Stronger still is the parent's desire for the educational advance of the child, a desire which finds expression in the effort to give the children every possible year of school, in the pride in the child who advances rapidly and in the efforts made for the little ceremonies of graduation. A theory of industry which omits to consider this vital want of the people is incomplete. And we may fairly say that the older theories of industry have been incomplete in that they have given little opportunity for the workman who desires advancement through education, and have confined the major part of the worker's effort for education to his hours outside the factory.

It is a most significant fact that the educational theories of the science of management, assuming far broader responsibilities, assume the constant educational development of the worker during his working hours and proves that that development is profitable to employer and to employee alike. How lamentably the older systems of management failed along these lines many of us know. The beginner in industry, once he left the school behind and entered the doors of the factory, was (and is) but too likely to find himself bound

by the old factory system to some single monotonous task, to toil wearying and stultifying to body and spirit alike, to a repetition tending to make automatons of human beings by the continual repeating of like tasks. Of good coherent instruction in shop methods there was practically nothing. The general foreman of the shop into which the beginner went was too busied with a hundred other cares to give more than a cursory attention to teaching anything. Many of the older workers had no real understanding of the principles underlying their tasks and most had little or no skill in teaching. The education of the beginner in the shop consisted largely of painfully picking up such scattered information as he could reach, generally obtaining the few facts he learned by a most wasteful expenditure of energy, only able by really prodigious efforts to overcome the barrier between unskilled and skilled labor.

It is entirely true that a comparatively small number of skilled workers were developed by this process, a small extra energetic minority, who, by dint of making the great effort required for the carrying on of night school or correspondence courses, or by an extraordinary persistence which dragged from foremen or shopmates the traditional knowledge of the trade, made themselves skilled workmen. But men with such persistence are the exceptions. Offered little opportunity in industry itself, unable because of lack of facilities, of physical or mental strength or of money in excess of a bare living wage, to obtain education, the majority of workers under the old factory system fell readily into low waged positions, became automatons and, losing initiative and mental alertness, limited their own advance. Nor has the penalty for this policy fallen upon the worker alone. The consumer has suffered in increased cost for lack of education. Stupidity, blunders, and delays make goods produced high in cost of production with increased selling cost to the consumer. Too little attention in the consideration of the high cost of living has been paid to the limitation of output that results from the lowering of production due to the untrained worker.

It is true that these concepts are not widely realized. It is entirely possible that the average thinking American workman does not wholly formulate his discontent with the opportunities of advance offered himself or his child under the old forms of management. But it is not a matter of question that discontent with the oppor-

tunities offered for mental and material advance exists and that this discontent is a powerful factor in the present industrial unrest. I can speak for many thinking workmen, whom I have known, when I say that the blank wall which so much of present day industry presents against their advancement is the basis of one of the bitterest and best grounded causes of complaint against the old style of management.

With the realization of that ground for complaint in the past, it is no wonder that the thinking workman scrutinizes carefully any new philosophy of industry which comes before the world to see what it offers along educational lines. When he finds in the science of management a complete theory of education aimed towards the highest possible development of each individual worker; when he finds that the education of the worker in the shop is an inherent part of that theory of management; when he finds that no pains are spared to make that shop education of the highest possible grade; when he sees those theories working out in practice, the worker hails that opportunity with joy not only for himself but even more for his child. He sees that here, as in so many other places, scientific management offers every worker an opportunity to reach a far higher plane than the older theories of management ever offered him. He sees that it opens a gate which was shut before.

Specifically what do the educational theories of the science of management offer the worker? They offer him the best knowledge or information obtainable on any given subject, express that knowledge in the best text-books obtainable and offer the worker the best teachers obtainable, all with the intention of enabling him to develop himself to the greatest possible extent. We may divide the advance of educational work in any industry into three divisions. The obtaining of necessary exact knowledge or information concerning a given subject or the development for the worker's use of the content of a course; the preparation of texts which shall record that knowledge and make it available to the student ; the obtaining and developing of teachers to teach the best methods of using the knowledge so obtained and so recorded. Suppose we take up those three divisions and see what the attitude of the worker is towards the work done in each of these divisions.

First and foremost the worker realizes that the knowledge gathered for his use is, in Dr. Taylor's phrase, "exact knowledge

substituted for guesswork." The worker has been used, under the old style of management, to seeing methods laid down by guesswork without sufficient study of actual conditions, sometimes apparently quite without reference to actual conditions. He believes in many cases that he has better methods than the ones given him, but he is not encouraged to mention his own beliefs. If changes are made, they are made solely by command, and the basis on which these changes are made is hidden from sight.

The difference which exists between these methods and those followed in scientifically managed shops could hardly be more diametrically opposed. In shops where the science of management is in force, the worker finds that all the best workers in the shop are cordially invited to give the best they know to bring about the development of a science of the particular business in which they are engaged. He finds that before an instruction card is made out at all (or to put it otherwise before a lesson is set down) that the methods of doing the work in question have been studied by a technical expert who has called to his aid the combined knowledge of the best men in the shop. He sees the careful development and practical experimental study of the work going on around him, and comes to recognize that this work is being done by men in whom he has confidence. He finds that the engineer in charge is wholly ready to talk and explain the work that is going on, glad to receive and use suggestions and wholly ready to recognize the practical value of the thought of men who have been working on a given type of work for years. He finds, moreover, that these engineers are proceeding on certain basic principles, that they are working to apply to industry the best that science has accomplished, and that they use the best modern scientific methods in discovering the unknown in industry. Here, generally for the first time, the worker meets the open mind of science, which refers all questions primarily to collected, correlated and recorded fact instead of to any man's guess or theory. One result is inevitable: the worker comes to thoroughly respect the knowledge or information of his trade thus obtained.

The obtaining of knowledge is but one division. Its proper expression is quite as important if it is to be useful to man. The worker, under the old style of management, was used to verbal orders hurriedly given by a foreman or to written general instructions inadequately expressed and badly written in long hand. Under

scientific management, he receives a carefully prepared instruction card stating minutely the best method for doing the work, and illustrated, wherever advisable, by drawings or photographs, showing the proper methods to be used. With illiterate labor the instruction card may be wholly made up of pictures showing the proper methods of performing the operation in question. With highly skilled labor the illustrations may be wholly omitted. In any case everything that can be done is done to make the work (or the lesson, if you will) clear to the worker. The worker finds that expression is not considered a minor matter and that the making of instruction cards is not a matter left to any chance clerk. Rather it is a matter to be studied carefully by the best brains in the shop. He finds, moreover, that he himself is expected to bear his part in the making of those texts, in that he is expected to report back whenever an instruction is not clear to him and he finds that the instruction cards are constantly being revised in an attempt to gain greater clarity of expression. Instruction cards of this type produce respect in and obtain cooperation from the worker.

All the work of obtaining the necessary knowledge or information, of recording it and expressing it in the form of instruction cards is preliminary to the actual doing of the task or the lesson. That performance is the next step to be considered. Suppose we assume that the time has come for the worker actually to do the task under guidance. Let us stop a moment and briefly compare the conditions, so far as educational opportunity goes, between that which existed at the beginning of the worker's task under the older types of management and that existing under the science of management. Under the former the worker began his task with information picked up and gathered at odd minutes from shopmates and foremen, some of it good, some of it bad, an odd mixture whose effectiveness was distinctly dubious. Under the latter the worker begins a task which is the result of the best knowledge on the subject available, of knowledge collected and sorted with care, by the joint efforts of technical experts and practical shop men, a task which has been expressed by men trained in expression. Is it any wonder, under those conditions, that the respect of the worker for the new type of management begins to turn to liking?

To make recorded knowledge live we must have the teacher. Few of the theories formulated by Dr. Taylor are essentially greater

than that which concerns the reversal of the theory of foremanship. The old foreman was a commander and a driver. The functional foreman of scientific management is a teacher and cooperator. The old foreman ordered. The new functional foreman teaches, clears the path and shows the way. According to Dr. Taylor's theory the teaching of men in the shop is divided among eight teaching and recording functions. Stated in the form of functions, these eight are as follows:

One, routing; determining and recording the sequence and the way the general operations shall be done, or, to put it otherwise, determining the proper paths for the flow of work.

Two, instruction card making; the writing and revising of the texts which show the best methods of doing any given operation.

Three, preparation; the preparing and inspecting of all materials to be used in the doing of the task and instruction in the methods to be used in preparing to do the work.

Four, machine control; the determination of the proper machine adjustments which will make for the best accomplishment of the task.

Five, inspection; the keeping up of the quality of the work.

Six, maintenance; the keeping up of the equipment to the highest point of efficiency.

Seven, recording; the entry of all records which concern the operation.

Eight, discipline; the arbitration of all those questions which must occasionally arise when two or more men work together.

Wherever men work in cooperative industry those eight functions must exist. The more completely those functions are developed the better the work and the greater the educational opportunity of the worker. When the shop is large enough one man or more should be assigned to each function. Where the shop is small more than one function may be assigned to a man, remembering always that efficiency in any one function in an individual varies with the number of functions he has to carry. The greater the number of functions assigned one individual, the less his effectiveness in any one. Taking their names from the old nomenclature of iron and steel, where the science of management first began, a part of these teachers and recorders were called bosses, another part, because they worked at desks, were called clerks. So the men who worked

at routing, instruction cards and records, as they worked at desks, were called route clerks, instruction card clerks and cost and time clerks respectively. The men who worked in the shop, who performed the functions of preparation, of machine control, and of inspection were called gang bosses, speed bosses, inspectors and repair bosses. The man who acted as arbiter was called the shop disciplinarian. Those names, used originally in the iron and steel industry, as was said before, have changed as the science of management has progressed into other industries, the gang boss is now called the group foreman in some industries. The speed boss is called the machine instructor, the repair boss has disappeared into the department of maintenance. Here, as in all science, the form and the word is a minor thing, the spirit is a great thing, and the spirit of functional foremanship is cooperation and education. Every functional foreman performs some educational function.

If education is to be effective the student must respect the ability of his teacher. No one, certainly, is better able to penetrate the cloak of pretended knowledge than the thinking American workman. It becomes evident, therefore, that this new conception of a foreman changes the basis on which a foreman is to be selected. Instead of being the task master who is to force the maximum out of his workers, he is the teacher who is to show the worker the best way and teach him how to follow it. The choice of the foremen teachers then must be a matter of very real importance and the importance of selecting and training those teachers is fully recognized by those working in the science of management.

Many qualities are desirable in a functional foreman, but three things are absolutely essential: power to do and do well any task or lesson given to a worker; power to express to the worker the best way of doing a task; and willingness to cooperate with the worker in working out the accomplishment of a task. First and foremost the functional foreman must have a practical knowledge of the tasks to be done. Nothing would be more foolish than to engage as a teacher of French, a master who knew only German and English. Nothing would be more foolish than to engage as a functional foreman a man not thoroughly able to perform expertly any operation to be done by any operative under his charge. The functional foreman must primarily be able to serve as demonstrator. He must secondarily be able to express his knowledge. He must thirdly be

willing to cooperate. It speaks well for America that men who can do all these things can be found in the industries into which the science of management has gone.

Functional foremen so chosen command the respect of the worker. It is of importance that their functions should most effectively advance the education of the worker. Let us see how the work of instruction is divided among the different functions. The functions of collecting knowledge, which includes the foundations of the function of routing and of expressing it in the form of instruction cards, have already been considered. That leaves six of the functions to be briefly considered here under the general heads of the duties imposed on them.

Preparation: The hindrances placed in the worker's way through lack of preparation under the old types of management have been great. The worker has been accustomed to being forced to wait for supplies, tools and materials, to being forced to obtain for himself this tool or that instruction. Under scientific management he finds that these nagging annoyances have been removed and that the functional foreman in charge of preparation sees to it that everything necessary for the task is at the worker's bench. This is the work of the gang boss, to use the machine shop term, and it is the duty of this functional foreman to see that the worker understands the proper setting of the work in the machine. The function of the gang boss includes instruction in all parts of the work up to the actual starting of the machine or hand operation.

Machine control: Preparation being completed, the machine instructor (first inspector or speed boss) takes charge, sees that the machine is properly adjusted, and in machine shops looks especially to the proper setting of speeds and feeds. (Whence the name "speed boss.") It should be particularly noted that the speed boss in a shop under modern methods of scientific management has nothing to do with the speeding up of the men, and that any foreman who endeavored to drive his men or to speed them up beyond the time justly and cooperatively set for their task would be severely reprimanded. The science of management has no use for the ineffective drive and hustle, the eternal rush, of the old type of management. It uses far fairer and more effective means to obtain increased effectiveness and increased output. The speed boss is expected to remain on any new work until the man doing the work understands

the best methods of doing that work, until the worker can follow his instruction card properly and until the work is proceeding satisfactorily. More than that the speed boss or machine instructor is required to be on call at any time during the whole operation to give assistance whenever needed or to step to the machine and do the work properly himself should need arise.

Inspection: The inspector determines the quality of the work, instructs as to methods for obtaining satisfactory quality, advises as to finish and completeness, teaches the care which produces best results and draws from the finished product of any operation the lesson which may bring an improved product the next time the operation is performed.

Maintenance: The proper care of a workman's tools and appliances is an art which, as the skilled workman recognizes, adds much to the effectiveness and ease with which the operative does his work. The repair boss (the maintenance man) teaches the worker the proper upkeep of his machine and permanent tools. The tool room assumes the responsibility of furnishing him with all other tools, kept in the best possible condition.

With proper instruction from teachers whose knowledge and ability he is bound to respect, who perform the functions outlined above, with properly prepared instruction cards and with the best available knowledge at his command, the worker enters upon the task that is set with a realization that every effort has been taken to give him the best methods possible. To put it another way the worker enters on the laboratory determination of the task set down with confidence in the work already performed. The worker is required to do the task or lesson set down in the way that it has been formulated. That is a *sine qua non* of educational theory that exists in every school in the country. Everywhere the student is required to do the lesson set by the teacher. Nowhere can he wander to other lessons at his own sweet will. Dr. Taylor in the third of his principles of scientific management speaks of bringing the science and the worker together. Like every other educator, he requires that the student shall do the work assigned at the time assigned. The workman, once given the formulated task, must do it in the way set down and according to the instruction of the teacher foreman. A student required to do a laboratory exercise on the determination of a specific heat can hardly expect to substitute for

it one on specific gravity and find the substitution satisfactory. The operative is not required to do a new task involving new elements in any given time the first time it is presented to him. It is the method, not the time, which is involved in the first learning of new tasks.

The task once done in the way shown, however, a new theory presents itself. In the ordinary schemes of education, as of industry, the scholar is not cordially invited to better the methods shown. In the educational methods of the science of management the scholar or worker is cordially invited to improve any method shown, once he has performed the task in the way assigned. Only one requirement is made, that all proposed methods shall be submitted to the impartial laboratory test of actual operation, a test which the workers in scientific management demand of themselves. I am sure that I am speaking not only for myself but for my associates when I say that it is our constant feeling that no single factor has advanced the science of management more largely than the wise suggestions of men working at the tasks that have been set. It is our feeling that the advance of scientific management is the work of many men, that the open mind ready to receive gladly all constructive suggestions is an essential to the worker in this field, and that the cooperation of the operative in advancing all methods in industry is very well worth the obtaining. Nor is that cooperation difficult to obtain. The worker who weighs the educational theories of scientific management welcomes the opportunity of cooperating with his teachers in the advancement of knowledge.

The theory of education presented here goes beyond any single course or single machine. One of the greatest barriers to permanency of employment is the unevenness of work in different departments of a factory at different periods of the year, a condition especially evident in those factories dealing with a seasonal trade. One month departments A and B are rushed and the men in departments C and D are laid off. The next month the case is reversed and the men are laid off in departments A and B while the work is rushed in departments C and D. The science of management by its studies of the relation of sales to types of product, by its increase of production and by its general advances in the conduct of industry, tends to do away with this condition, but it also works specifically against this state of affairs by offering education along the lines of

work in departments A and B to the men in departments D and C and vice versa, enabling them to gain such mastery of different parts of their trade as shall give them permanent employment in different departments and paying them higher wages for each educational advance. Nor has this opportunity for wider series resulted in the employment of less men. The advance of industry under the science of management has provided places for all.

The development of the individuality of the operative under these methods should be especially noted here. This offer of education along different lines, this attempt to develop every employee as far as possible, to leave every gate to advancement open is, of course, directly opposed to the deadening monotony of repetitive tasks so characteristic of the old type of management. It is the belief of the engineers engaged in carrying forward the science of management that the broader the outlook and capacity of the worker the greater the industrial advance and the greater the total effectiveness. It is the constant aim of the science of management to advance the interests of employer and employee alike. "Science plays no favorites."

The soundness of the educational theories of the science of management may perhaps be still further exemplified when we consider their application to a well-run department of chemistry in a technical school of the first grade. The methods used are strikingly analogous. Before determining the content of the courses to be offered, the instructors in such a department determine the general routing of the courses, deciding, for example, that industrial chemistry shall be offered the second half of the junior year and water analysis the first half of the senior year. The general routing finished, the content of the individual courses is determined, a process analogous to our collection and correlation of industrial knowledge, and, as a third step, instruction cards in the form of laboratory manuals, outlines, lesson sheets and the like are prepared. Tasks are set in approximate relation to the time allotted to each course and the necessary apparatus and material are placed in stores. The instructors in doing these things have performed the functions of route clerks, instruction card clerks and store clerks.

Once bring the student into the experimental laboratory of such a chemical department and the functional teachers may be translated bodily into laboratory instructors. The instructor who

sees at every laboratory exercise that all material and apparatus required for that given exercise are on hand and who gives directions as to the proper arrangement and setting up of apparatus exercises the functions of gang boss. The instructor who teaches the proper methods of doing the work is the speed boss or group instructor. The instructor who corrects note books and checks analyses is the inspector, while certainly the dean fulfils the office of shop disciplinarian. Records of performance, of attendance, and of marks, are clerical records performed by clerks who correspond to the cost and time clerks. The teaching of proper care in the cleaning and upkeep of individual apparatus, moreover, is a teaching function of the department of maintenance.

The thinking worker, weighing the educational methods found elsewhere with those offered by the science of management, finds in general that they compare favorably with the best advances of education in strictly educational fields. That single fact is a power toward making his attitude a favorable one. But still more powerful is the fact that the worker soon comes to recognize the open mind of the scientist engaged in this work, the constant search for better methods than any used before, the feeling of the men developing this science that its development is no individual matter but the business of many men, and that from any man they are glad to learn. From all these things the worker learns the worth of testing all things not by dogma but by the light of the best scientific method at command.

With that recognition of the open mind of science, the thinking worker comes to recognize another point—that the science of management, like the sciences of physics, chemistry and biology, all of which it calls to its aid, is a living, growing organism, constantly advancing, constantly replacing one method by a better, constantly revising, constantly bettering its mechanisms and its systems. Gradually he comes to be firm in his belief in the science that underlies all natural phenomena and in the latest science, the science of management. The workman who gains this belief becomes a powerful agent in that great task of the science of management, "The substitution of exact knowledge in industry for industrial guesswork."

What is the attitude towards scientific management of my friends, the workers at the machines, who are working under the direction of the science of management?

Cordial appreciation of the opportunities given them by that science, hearty willingness to cooperate in the development of that science, thankfulness that a freer, broader, finer life will be open to their children because the science of management has come into being.